CHAPTER

37

Marine Fishery Regulations and Policies for Conservation in India

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Introduction

India, being one of the largest marine fisheries in the world, has high stakes in managing its coastal and marine resources. The marine resources in India are highly diverse comprising of an exclusive economic zone of 2.02 million km^2 besides a continental shelf area of nearly 0.50 million square kilometers. The capture fisheries sector in India, though experienced a rapid expansion in the recent decades with the advent of mechanized fishing during 1980s, has started showing signs of over capitalization and consequent crises. Experts in the field have already highlighted the impending problems such as declining catch rate and diminishing returns, overfishing and /juvenile fishing leading to depletion of fish stock, rampant destruction of marine biota due to high-intensity trawling, and so on (Devaraj and Vivekanandan,1999; Ramachandran, 2004). The imminent crisis is increasingly getting reflected through frequent conflicts between various groups/factions of fishermen/vessel operators over their rights and shares over the resources. These circumstances echo the need for a strong regulatory and management regime for protecting and preserving the maritime resources of the sub-continent. Though India is not new to regulations in fisheries sector with a number of laws and rules in place for more than a century, the emerging scenario merits a relook into the existing regulatory framework. Against this backdrop, this chapter presents global approaches to marine fisheries regulations along with a broad overview and critical appraisal of India's marine fishery regulations and policies aimed at conservation and sustainable development.

Approaches and tools to fishery regulations

A wide variety of approaches and tools are used for regulating fisheries across the world. As the primary aim of regulating a marine fishery is to maintain a sustainable level of biomass and productivity in the wild stock, efforts in this direction are mainly directed to limit the rate of extraction. The basic scientific concept followed in this context is the 'maximum sustainable yield (MSY)' which is the maximum level at which a resource can be routinely exploited without long-term depletion. The idea was evolved in fisheries in the early 1930s, and attained popularity in the 1950s with the advent of 'surplus production models' capable of actually estimating the MSY based on oceanographic and marine data. However, subsequent assessments revealed that while establishing a sustainable level of harvest as goal with intuitive appeal, the pursuit of MSY ignores many relevant economic and social factors that are critical to the sustainability of a fishery (Larkin *et al*, 2011). A new concept namely, maximum economic yield (MEY) was introduced that defined the level of harvest or effort that maximizes the sustainable net returns from fishing (Grafton *et al*,

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2006). This approach picked up momentum with developments in the area of bio-economic modeling that combines the underlying stock dynamics with the harvest function and the costs of harvest and economic value of the extracted resources. An illustration on how MSY and MEY compares with each other is presented in Figure 1. Declaration of total allowable catch (TAC) limits, especially by temperate fisheries administrations, is generally based on any of the above two concepts. MSY/ MEY can be achieved through alternative strategies such as limiting access to the resources, setting caps on quantity harvested, limiting the fishing efforts, maneuvering the area and time of harvesting so as to avoid spawning and juvenile fish, and so on. These basic strategies became the guiding principles behind fishing regulations that forms essential components of all major fisheries management programs in the world. Accordingly, approaches to fisheries regulation can be broadly classified into five categories, viz., (i) Access-control based (ii) Output/catch-based (iii) Input/effort-based (iv) Temporal and (v) Spatial. However, such a classification is not water-tight and is subject to changes depending upon contexts. While the first three approaches are primarily directed to limit the rate of extraction from the stock, temporal (mainly seasonal bans) and spatial approaches generally target to minimize destruction to sensitive stocks (endangered species, spawning and juvenile fish).

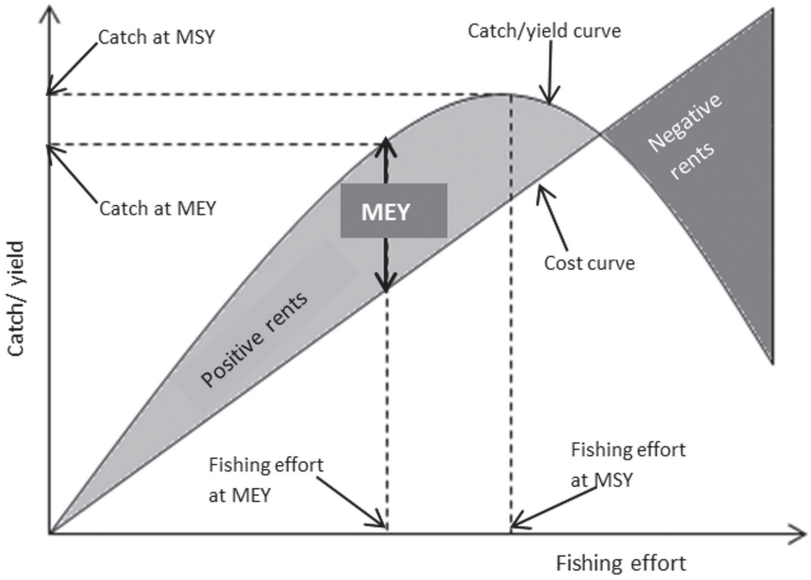

Figure 1. Maximum sustainable yield (MSY) and maximum economic yield (MEY)
Source: World Bank (2009)

A brief account of the main fishery regulatory tools that fall under the above five approaches along with a few notable examples is presented in Table 1. Among the various measures, access control is one of the most basic and easy-to-implement regulation that includes tools such as licensing and registration that limit fishing access based on a set of basic minimum requirements. It also includes options such as limited entry permits issued to impose severe access restrictions, and

those like group fishing rights and territorial use rights for fishing (TURFs) that are restricted to specific communities or beneficiary groups. Output-based regulatory tools include collective/ individual catch quota, vessel catch limits and minimum size limits. Catch quota are generally fixed based on TAC estimates derived based on the concepts of MSY/MEY and are subsequently rationed among beneficiaries based on certain qualifying criteria. The quotas are either transferable or non-transferable depending on the degree of regulation. Minimum size limits, another output-based regulation, are mainly set to prevent harvesting of juvenile fish thereby to hasten rebuilding of excessively exploited stocks. Nevertheless, output control measures are data intensive and requires substantial amount of resources for their implementation, thus limited only to a handful of advanced fisheries. Input-controls focus on restricting the types of inputs as well as effort involved in the stock extraction process and include gear restrictions that set limits on the type, designs and mesh-size of the gears used, engine power restrictions, as well as size restrictions on fishing vessels. Though they are relatively easier and less costly to implement as compared to output-based measures, one major demerit is the difficulty associated with assessing the extent of control on each input so as to derive desired results (FAO, 1997). Temporal controls are widely adopted across the world, wherein, the idea is to regulate resource extraction during specified seasons of the year or to fix time limits to fishing. Seasonal fishing bans, a common temporal strategy, is adopted both in temperate and tropical waters to minimize destruction of spawning population. Spatial restriction approach on the other hand, includes alternative tools such as designating marine protected areas (MPAs), temporary area closures and spatial zoning. MPAs have received considerable attention in the recent times and are increasingly employed world-wide as an ecosystem-based management strategy to conserve marine resources and to prevent the degradation of sensitive marine ecosystems through coastal protection, habitat restoration and biodiversity conservation (Halpern, 2003; Kaplan *et al*, 2015).

Table 1. Major tools for regulating capture fisheries

Regulatory approach	Specific tool	Description	Major examples (with year of first introduction)
Access controls	License	License is the basic access requirement for a fisher to undertake fishing.	Almost all major fisheries in the world.
	Registration	Registration of fishing vessels for identification purpose is mandatory by law in most fisheries.	Almost all major fisheries in the world.
	Limited entry permits	Holders of the individual entry permits are only allowed to compete for harvests from a common pool.	Salmon fishing licenses (Alaska, 1974, British Columbia, 1968); Western Australia rock lobster (1963).
	Group fishing rights/ fishing cooperatives	Limited entry permit holders agree on a harvesting system usually by written contract.	Pacific whiting Conservation Cooperative (1998); Bering Sea Pollock Co-ops (1999).

	Territorial use rights for fishing (TURF)	Access to fishing areas limited by custom or law to members of a village, tribe or other groups.	Community-based TURFs in Oceania and Japan; Coromandel coast fisheries, Tamil Nadu, India.
	Collective catch quota	Aggregate catch quotas allotted to specified beneficiary groups.	Western Alaska Community Development Quotas (1994).
	Individual catch quota	Species-specific catch quotas (in terms of weight) allocated to individuals. They are generally transferable / tradable.	Individual transferable quota (ITQ) programs in Alaskan halibut/sablefish fishery (1995); ITQs in Southern Australian shelf for bluefin tuna (1983).
Output/catch-based	Vessel catch limits/ quotas	Catch quotas specific to vessels.	Individual Vessel Quota (IVQ) system for the ground fish trawl fishery in the British Columbia (1997).
	Size restrictions	Minimum legal sizes (MLS) specified to individual fish species to prevent juvenile fishing.	Minimum legal size (MLS) restrictions in Kerala fisheries, India (2015); MLS restrictions in Baltic cod trawl fishery (1994).
Input/effort-based	Gear restrictions	Restrictions on the type and designs as well as mesh-size of the fishing gear used.	Mesh-size regulations in Baltic cod trawl fishery (1994); Mesh-size limits under the marine fishery regulatory acts of India.
	Engine power restrictions	Regulations by placing an upper-limit on the engine horse power.	Common Fisheries Policy of Council of the European Union, 2009.
	Vessel size restrictions	Size restrictions on fishing vessels applicable to specific fishery fleets, especially in terms of their length/ tonnage.	British Columbia Ground fish trawl fishery (1997); Nova Scotia ground fish fishery, Canada (1989).
	Seasonal fishing ban	Fishing bans imposed during specified seasons in a year, mainly to prevent fishing during spawning.	Seasonal fishing bans in eastern and western costs of India (1980 onwards); Closure of North sea beam trawl fleet to cod fishery (2001).
Temporal restrictions	Fishing duration restrictions	Limiting the duration of fishing by an individual/ vessel (eg: limits on hours/ day, days/season, time away from port, etc.)	Effort quotas (fishing duration) for regulating demersal fish stocks in the Faroe Islands, Denmark (1996); 'Days-at-sea' regulations for New England ground fish fleet (1995).
	Fishing time restrictions	Restrictions to fishing during particular time of the day (eg: regulation of night fishing).	Prohibition of trawl net operations between 6 pm and 6 am in Maharashtra coast, India (1981); Night fishing ban in Lamu, Kenya (2011).

	Marine protected areas (MPA)	A protected area where fishing is prohibited. MPA area divided into six categories by IUCN based on strictness of the protection regime.	MPAs in New South Wales, Australia (2002); Florida Keys National Marine Sanctuary, USA (2000); MPAs in the Indian peninsula (1978).
Spatial restrictions	Temporary area closures	Temporary area closures are practiced mainly to protect juveniles in specific areas where certain species come for spawning.	Area closures to protect octopus in Velondriake marine area in Madagascar (2004).
	Spatial zoning	Restricting access to different groups of fishers (artisanal fishers *versus* mechanized fishers) based on distance from shore/ depth of water.	State marine fisheries regulations, India (1980).

Source: Parappurathu and Ramachandran (2017)

Fishery regulations in India

Marine capture fishery in India is governed by a number of rules and regulations which are put in place from time to time with cross cutting mandates and objectives. The pioneering attempt to regulate fishing in India was the introduction of The Indian Fisheries Act, 1897 by the then British administration. This was followed by several local regulations promulgated by various princely states in the subsequent years of British Raj. In the post-independence era, the enactment of two crucial laws, viz., The Territorial Waters, Continental Shelf, Exclusive Economic Zone and other Maritime Zones Act, 1976 and Maritime Zones of India (Regulation of Fishing by Foreign Vessels) Act, 1981 has significantly altered the way fishery in the country is regulated. These Acts which deal with demarcation of maritime zones for fishing and ocean administration were the offshoots of the UNCLOS negotiations. Other important legislations/policies passed during the 1970s and afterwards and which are relevant for marine fishing activities include, Wildlife Protection Act, 1972; The Forest Conservation Act, 1980; The Environment (Protection) Act, 1986; The Coastal Regulation Zone (CRZ) notification, 1991; New Deep Sea Fishing Policy, 1991; Biological Diversity Act, 2002; Comprehensive Marine Fisheries Policy, 2004; notifications declaring selected coastal areas as MPAs from time to time, and so on. The latest effort in this direction is the National Policy on Marine Fisheries, 2017 which was notified on 28th April, 2017 (GoI, 2017).

As per the clauses under the Act of 1971, the areas up to 200 nautical miles from the territorial sea baseline is designated as the Exclusive Economic Zone (EEZ), wherein the country has sovereign rights for the purpose of exploration, exploitation, conservation and management of the natural resources as well as for producing energy. Areas up to 12 nautical miles (nm) from the baseline are designated as territorial waters. As per the Seventh Schedule of the Constitution of India, the states have the jurisdiction to govern fishing and fisheries in the territorial waters, whereas the union government reserves its jurisdiction beyond territorial waters, i.e., between 12 nm and 200 nm. The marine fishing activities within the territorial waters of maritime states are governed by the

respective Marine Fisheries Regulatory Acts (MFRAs). Kerala and Goa were the pioneering states to pass their own MFRAs in the year 1980, which was followed suit by other maritime states in the subsequent years. The MFRAs contain several provisions to regulate, restrict or prohibit unsustainable / destructive fishing practices, to define access rights, to impose spatial and temporal fishing restrictions and to make licensing and registration of fishing vessels compulsory. Clauses to penalize non-compliance and appellate provisions are also inbuilt in them so as to ensure fair governance of fishing and related activities. The specific details of the legislations and regulatory provisions contained therein with respect to the maritime states of India are presented in Table 2.

Table 2. Capture fisheries regulatory framework in maritime states of India

Maritime State	Access controls	Temporal controls	Spatial controls	Input/ effort-based	Output/ catch-based	Legislation/s in force
Gujarat	Registration and licensing of fishing vessels.	Seasonal fishing ban (SFB) (Jun 1 – July 31, 61 days)	Artisanal: up to 9 km; Mechanized: beyond 9 km.	Square mesh of minimum 40 mm size at 2003. cod end need to be used for trawl net; Gillnet with mesh size less than 150 mm prohibited.	-	The Gujarat Fisheries Act,
Maharashtra	-do-	SFB (Jun 1 – July 31, 61 days); Mechanized vessels with trawl net prohibited between 6 pm and 6 am.	Mechanized (trawl net) : beyond 5-10 fathom depth in specified areas; Mechanized (any type with more than 6 cylinder engines): beyond 22 km.	Use of purse-seine gears by mechanized vessels at specified coastal zones prohibited within territorial waters.	-	Maharashtra Marine Fisheries Regulation Act, 1981 (Amended in 2015).
Goa, Daman & Diu	-do-	SFB (Jun 1 – July 31, 61 days)	Artisanal: up to 5 km; Mechanized: beyond 5 km.	Mesh-size limits of 20 mm for prawn and 24 mm for fish.	-	The Goa, Daman and Diu Marine Fishing Regulation Act, 1982 (Amended in 1989).
Karnataka	-do-	SFB (Jun 1 to July 31-61 days)	Artisanal: up to 6 km or up to 4 fathoms (whichever is	Ban of cuttle fish fishery using FADs; Ban on light fishing.	-	The Karnataka Marine Fishing Regulation Act, 1986.

			farther); Deep sea vessels (up to 50 feet length): beyond 6 km Deep sea vessels (>50 feet length): beyond 22 km.			
Kerala	-do-	SFB (Jun 15-July 31, 47 days) [1]	Artisanal: 32 -40 m depth in the first zone[2] and 16-20 m depth in the second zone; Mechanized vessels (< 25 GRT): 40-70 m depth in the first zone and 20-40 m depth in the second zone; Mechanized (> 25 GRT): beyond 70 m depth in first and beyond 40 m depth in second zone.	Mesh-size regulations: code end minimum mesh size of bottom trawl net-35 mm; ring seine and driftnet minimum mesh size – 20mm.	Minimum legal size for 58 fish and shell-fish species notified to control juvenile fishing.	The Kerala Marine Fishing Regulation Act, 1980 (Amended in 2013 and 2017).
Tamil Nadu	-do-	SFB (April 15 to June 14, 61 days)	Artisanal: up to 5 km. Mechanized: beyond 5 km; Fishing within 100 m below a river mouth is prohibited; The number of mechanized fishing vessels permitted in any specified area subject to restrictions.	No fishing gear of 100 mm mesh from knot to knot in respect of net other than trawl net to be used; Pair trawling and purse seining are prohibited.	-	Tamil Nadu Marine Fishing Regulation Act, 1983 (Amended in 1995; 2000; 2011; 2016).
Andhra Pradesh	-do-	SFB (April 15 to June 14, 61 days)	Artisanal: up to 8 km; Mechanized	A minimum 15 mm limit for mesh-size	-	The Andhra Pradesh Marine Fishing

			(< 15 m OAL): 8-23 km; Mechanized (< 15 m OAL): beyond 23 km.	for any gear; Shrimp trawlers not allowed without turtle-exclusion device (TED).		(Regulation) Act, 1995 (Amended in 2005).
Odisha	-do-	SFB (April 15 to June 14, 61 days)	Artisanal: up to 5 km; Mechanized (<15 OAL): 5-10; Mechanized (>15 OAL): beyond 10 km.	-	-	Marine Fishing Regulation Act, 1981 (Amended in 2006).
West Bengal	-do-	SFB (April 15 to June 14, 61 days)	Artisanal & mechanized crafts with < 30 HP engine: up to 18 km; Mechanized crafts with >30 HP engine: beyond 18 km.	Mesh size regulations for specific gears: minimum 25 mm for gillnet/shore seine/drag net; 37 mm for bag net/ dol net; Standard trawl net fitted with TED to be used.	-	The West Bengal Marine Fisheries Regulation Act, 1993.
Andaman & Nicobar islands	-do-	SFB (April 15 – June 14, 61 days)	Artisanal & mechanized crafts with < 30 HP engine: up to 6 nm; Mechanized crafts with >30 HP engine: beyond 6 nm.	Standard trawl nets fitted with TED; Gillnets, shore seines and dragnets with mesh sizes above 25 mm only permitted.	-	The Andaman and Nicobar Islands Marine Fisheries Regulation Act, 2003 (Amended in 2011).
Lakshadweep	-do-	SFB (Jun 1-July 31, 61 days)	Use of purse seine, ring seine, pelagic, mid water and bottom trawl of less than	-	-	Lakshadweep Marine Fishing Regulation Act, 2000.

	20 mm mesh size, use of drift gill net of less than 50 mm mesh size and shore seine of less than 20 mm mesh size are prohibited in specified areas.

Source: Updated from Parappurathu and Ramachandran (2017)

Regulatory provisions under the MFRAs: A critical appraisal

MFRAs have been found effective to a great extent in regulating fishing within the territorial waters. These legislations make use of a variety of regulatory approaches such as access control, input/effort-based restrictions, spatial as well as temporal restrictions outlined above. However, output/catch-based controls have been sparsely used by the states (except in Kerala, where MLS for fish species are notified in 2015). Provisions for compulsory registration and licensing of fishing vessels, which are the basic access control measures used world over, finds place in the MFRAs of all maritime states and UTs. Temporal restriction of mechanized fishing or seasonal fishing ban (SFB) is another tool adopted across the maritime regions of India. The basic rationale is to restrict fishing activities during the time when most marine fish species undergo peak spawning so as to ensure natural replenishment of fish stock. Gujarat, Goa, Maharashtra, Kerala and Karnataka have been diligently practicing SFB for more than 2 decades and other states have joined force during the later years. The criteria in fixing the closure periods and the type of fishing activities restricted during SFB varied across states. However, to avoid conflicts of fishermen from different states, the Union Government appointed a committee in May, 2013 under the Chairmanship of Director, CMFRI to suggest uniform closure period for India's EEZ. The committee, based on scientific facts on spawning periods and other relevant details as well as stakeholder consultations across states, recommended a seasonal closure for 61 days (GoI, 2014). Based on this, the government fixed the ban period during April 15 till June 14 in East Coast and during June 1 to July 31 in the West Coast, since 2015. However, within their territorial waters, the States reserve the rights to decide on the fishing ban 'period' and its applicability on 'type of boats'. Several studies have shown the positive impacts of SFB in terms of reduction in fishing effort and short-term stock replenishments of major marine fish species (Vivekandnan *et al*, 2010; Thomas and Dineshbabu, 2014). Further, SFB is proven to improve the inter-sectoral catch distribution in favour of artisanal fishermen, as the closure is more or less in alignment with the spawning and recruitment of species like sardines and mackerals which form the backbone of the traditional sector (Joe, 2008). Though conclusive evidence on the impact of SFB in improving long-term sustainability of stocks is yet to come, it continues to hold promise as one of the important fishery management measures that has stood the test of time in India.

Spatial controls have been another set of fishing regulations that are widely being used to restrict unsustainable and destructive fishing activities in the seas. Spatial zoning is one such measure

used across states to designate specific zones in the coastal waters within which use of certain types of fishing vessels/gears/practices are restricted or prohibited. Zoning as a practiced in India targets two major outcomes: (i) to minimize excessive damage of marine biota through destructive fishing methods (eg: bottom trawling) in the in-shore waters and (ii) to maintain inter-sectoral distribution of fish catch by reserving in-shore areas for traditional / artisanal fishermen. The zones are specified either based on the distance from shore or in terms of depth of water. In general, in-shore areas for a distance of 5-10 km are reserved for artisanal fishermen who do not use any mechanized fishing activities or vessels beyond certain specified tonnage/engine power (Figure 2). However, such access restrictions are not revised from time to time based on the changes in fishing technology and practices, thereby losing relevance over time. For instance, the inboard motorized vessels used for ring seine operations in the Kerala dn elsewhere are often comparable with mechanized boats in terms of catch volumes thus violating the basic objectives of the policy.

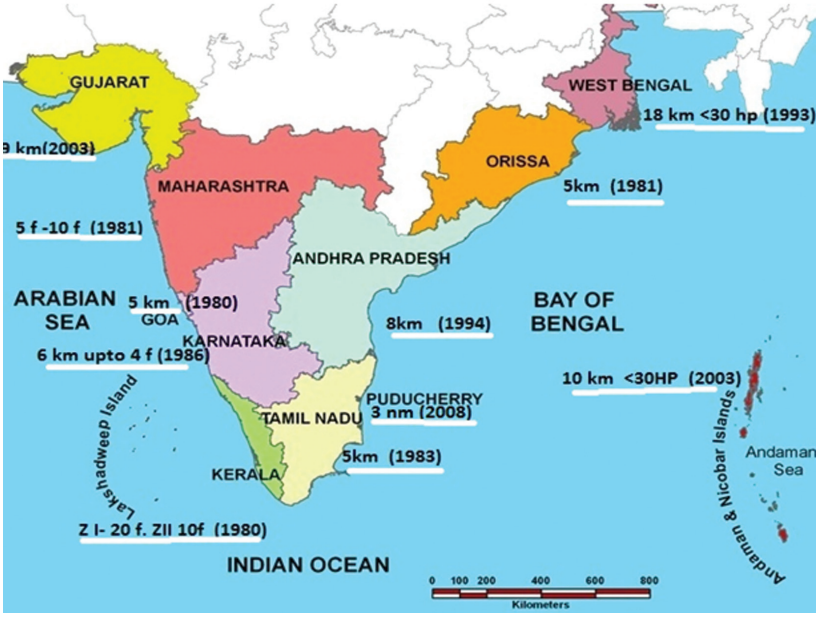

Figure 2. An illustration of spatial zoning wherein in-shore areas are reserved for artisanal fishing in India's territorial waters (Source: Parappurathu and Ramachandran, 2017)

Controlling the type/level of inputs/ fishing efforts are also hailed as a practical solution to regulate excessive exploitation of oceanic resources. The main tools presently being used include blanket ban of certain types of destructive fishing gears, mesh-size regulations, hook-size controls, turtle exclusion devices (TED), ban of fish aggregating devices (FADs) and so on. Gear restrictions are mainly targeted to minimize juvenile fishing to allow fishes to mature. However, these restrictions have largely been rendered insufficient due to poor enforcement mechanisms as well as the difficulty to judge maturity of fishes just based on body sizes. With this realization, the Kerala government notified the minimum legal sizes of 58 species of fishes/shellfishes in 2015 based on technical inputs

from CMFRI, Kochi. This is first of its kind of output-based regulation to have introduced under the MFRA framework of any maritime state so far. However, the effectiveness of this measure also depends on the level of enforcement that the state can achieve within economically viable limits.

Sui generis, community-based regulatory systems

Along with formal and institutional regulatory mechanisms, a number of *sui generis* regulatory and co-management systems have co-existed in various parts of coastal India. Most of these informal, community-based governance models have evolved over time and have limited administrative jurisdictions in the concerned locales. These traditional management systems have proved to be highly dynamic by continuously adapting to changing technological paradigms and emerging challenges, retaining their relevance even now. Some such widely documented cases include the *padu* system being followed in parts of Kerala and Tamil Nadu (Lobe and Berkes, 2004); *Kadakodi* system in northern Kerala (Ramachandran and Sathiadhas, 2006); traditional *panchayat* system along the Coromandel Coast of Tamil Nadu (Bavinck, 2001) and alternate-day fishing systems in Gulf of Mannar and Palk Bay areas. The primary concerns of all these systems are resource conservation and sustainable fishery management with community control of access rights and regulations of certain kinds of harmful fishing practices. Access rights are generally determined by collective decisions based on accepted set of criteria and norms within the community. For instance, in case of *padu* system, access to designated fishing grounds is limited to members of a specific caste group in the locality based on a lottery system for harvest site allocation. The *kadakkody* system is much more elaborate with executive and legislative functions, and acts as a regulator of resources, protector of livelihoods and a mediator of social conflicts (Baiju, 2011). The *panchayat* system along the Coromandel Coast is a similar community-based governance system that regulates access and usage of fishing resources, besides discharging conflict resolution among community members. However, none of the above systems are officially recognized and continue to function as parallel systems of governance with little legal sanctity.

Conclusions

This chapter throws light on the various regulatory provisions and policies for sustainable development of India's capture fishery sector. The chapter discusses in detail the access-based, temporal, spatial, input/effort-based and output/catch-based approaches for regulating fishing effort so that the resources are exploited at optimum level. Further, the chapter also undertakes a critical appraisal of the various above provisions as enforced under the purview of MFRAs of maritime states as well as other sui-generis modes of regulations and their limitations. The chapter underscores the fact that, though sectarian interests and lack of institutional will has held back regulatory consolidation of the sector so far, fast depletion of natural resource base in the region warrants joint action propelled by farsighted vision, common interests and shared responsibilities.

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